Learning Domains and the Process of Creativity

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Abstract

Creativity is viewed in different ways in different disciplines: in education it is called 'innovation', in business it is 'entrepreneurship', in mathematics it is often equated with 'problem solving', and in music it is 'performance' or 'composition'. A creative product in different domains is measured against the norms of that domain, with its own rules, approaches and conceptions of creativity.

However, learning in any discipline area consists of both product and process. While the product may be quite different in different domains, there are general principles of pedagogy that encourage creativity of process. 'Creative teaching' could be said to consist of setting up a learning environment that encourages students to see the essence as well as the detail of the subject, to formulate and solve problems, to see the connectedness between diverse areas, to take in and react to new ideas, and to include the element of surprise in their work. Such a learning environment involves not only appropriate materials and assessment techniques, but also methods of learning that address the important affective dimensions of creativity.

Introduction

How do we as educators set up a total learning environment so that creativity is enhanced in the process of learning and is evident in the products of learning? This question is at the heart of any debate on the quality of creativity for learning. In subjects in which the term 'creativity' is common (such as design), the whole idea of creativity is assumed to be an assessable component of the students' learning. In other

discipline areas the notion of creativity may be recognised as 'innovation' or 'problem solving'. Yet if we consider that 'creativity' can be discerned as part of a learning outcome we should also consider the total environment in which the learning outcome is discerned. The recent Australian focus on 'generic skills' and 'graduate attributes' suggests that creativity can be seen as an 'attitude' (Central Queensland University), as a 'way of thinking' (Macquarie University and University of Western Australia) or as a component part of a suite of workplace skills (University of Canberra). What is surprising is that the relationships between these ideas about creativity and learning are not explicitly teased out. We should consider what 'creativity' means from a holistic perspective.

In this paper we will attempt to answer the question posed above. We will do so by examining theories and ideas of creativity and considering how these ideas may be related to theories of learning. We will also discuss how creativity may be perceived in different learning environments (or 'domains'). We suggest that there is a relationship between the ideas of creativity and learning and the ways that educators develop environments that enhance student learning in different domains.

Theories and ideas of creativity

It is a fairly difficult exercise to discern what is meant by the term 'creativity', or to decide what may be interpreted as a 'creative' object, or to describe the cognitive traits that characterise a 'creative' person. David Bohm's opening words in his book *On Creativity* are: 'Creativity is, in my view, something that is impossible to define in words' (1998, p. 1). Certainly, one of the problems is the confusion of what may actually *be* creative: is it a person, an idea, or an object? If the whole idea of creativity is so nebulous, then an attempt to foster creativity in learning may be equally difficult. Noscal (1995) suggests that 'One commonly shared mechanism of creative thinking does not exist' (p. 27; but see Koestler 1964 later in this paper). We can, however, look at the discussion that surrounds ideas of creativity and see which aspects are important to our situation as educators.

If we consider that creativity is a characteristic of a certain type of person, or people with certain sorts of personalities and behaviours, then it would be a simple matter to choose only students in our courses who had specific personality traits. Theories of creativity that support this idea look for the *determinants* of creative thinking. Several researchers have sought to discover just what those determinants are, resulting in a mechanistic, or even computer-like, model for creative processes (see Sternberg 1988). A progression from this way of thinking is to determine what sorts of mind types may manifest different kinds of creativity. Jungian theory describes four mind types that may be related to different styles of creative processes. (These types

are usually ascribed to individuals using a questionnaire to classify their creative abilities into thinking/sensing, sensing/feeling, intuitive/feeling, or intuitive/thinking. This is called the Mind Type Scale: Noscal 1995, p. 25.) These theories of creativity contribute to our understanding of how creativity is brought about by looking at commonality or variation in aspects of personality, the composition of the physical brain and areas of it that may be related to creative problem solving. Some research focuses on the possible 'measurement' of creativity, relating it to the psychological 'measurement' of intelligence (Cropley 2001). However, they do not satisfy our needs as educators to develop creativity in the ways our students work, or in the outcomes of their learning.

Marvszewski looks not at personality traits as the determinants of creativity but at the sorts of real-world problems that allow for creative solutions.

> Creative problems are of divergent nature, they allow for achieving a certain aim in radically dissimilar ways. What matters in some cases is to arrive at not only one goal but a whole series of goals which fulfil the criteria specified beforehand. (1995, p. 30)

From this perspective, it is the nature of the problem that is creative, and whether the problem allows different conclusions and solutions. Moving one step further back, Csikszentmihalyi (1990, p. 193) suggests that in many fields the mark of creativity is the ability not to solve the problem, but to be able to discover a problem. This has important implications for teachers as it suggests that creative assessment methods should not prescribe certain solutions, but should give students an opportunity to first find the problem and then solve it. Support for this view can be found once again from Marvszewski, as he states:

> Certain qualities of intellect cannot be treated as universal factors favouring creativity or hampering it. Their influence depends on the situation in which the creative process is realised. The situation is not always controlled by an individual. When the situation is independent of the individual it can considerably thwart the creative process. (1995, p. 46)

So far, we have looked at creativity as a characteristic of a person, and as a response to a situation. We have not yet explored how creativity is perceived by teachers, students or by the community at large. Swede (1993) maintains that creativity is more than just a response to a situation and that it is a process. 'Creativity is a process that results in some sort of outcome that possesses at least two qualities: it must be unique and it must have value' (p. 2). He also suggests that this is not enough: that to be

creative it must be 'universally' recognised. Further, there has been an implicit assumption that individuals working alone are creative – Swede suggests that groups can also be creative (p. 3). Swede's ideas imply that creative endeavour must be understood as creative by people who are not the creator, and that there is something about the situation in which the creation has been placed that makes it significant and unique. The notion of 'group creativity' also suggests that creativity is socially constructed. For creativity to be recognised it must be perceived as unique and of value to a certain community of people.

We have seen now that creativity is recognised as a component of the environment. Our initial question can now be partly answered, in that educators need to define the ranges of creativity that are found within an educational environment and in consequence change that environment to support individual/group processes or products of creativity that will result in high quality learning.

A theory of learning

An assumption was made in the last sentence of the previous section, namely that high quality learning is desirable. Just what is high quality learning, and how is it related to creativity? In this section, we examine learning from a relational perspective. We take this viewpoint as we consider that learning, creativity and the total learning environment can only be seen in relation to each other. A relational perspective in learning is constituted from the students' perception of their learning environment and how they understand their own learning as part of that environment.

Saljo (1979) and Prosser et al. (1994) suggest that there is a relationship between how students go about learning and how they understand the totality of their learning experience. Marton and Saljo (1976) suggest that students' approaches to learning may be related to their conceptions of learning, and Ramsden (1992) develops this theme further. Prosser et al. (1994) indicate that conceptions of learning also include an approach to learning that incorporates intentions and strategies. These are significant findings for understanding the role of creativity for learning. Each of these researchers suggests that the students' perception of the learning environment, their conceptions of learning and their approaches to learning are related. According to Swede (1993), the outcomes of creativity must be unique and valuable. The most sophisticated conceptions of learning, and the 'best' approaches to learning, then, may enable students to demonstrate creativity through their learning outcomes. The reverse could also be true: students with limiting conceptions and approaches may not be able to 'be' creative or 'demonstrate' creativity within a specific learning domain. What forms of learning, then, will inform our development of learning environments to support creativity in learning?

If conceptions of learning and approaches to learning are considered as different faces of the same coin, research in learning may turn up either face. Marton and Saljo (1976) determined that students reading a text either approached the task with an intention to remember all sorts of different facts in order to reproduce them when asked – this was called a 'surface approach' – or that students approached the task by looking for the underlying meaning of the text with the intention to understand – this was called a 'deep approach'. At the time, this finding was considered almost revolutionary yet bounded by common sense. They stated:

> We have found basically two different levels of processing to be clearly distinguishable. These two different levels of processing, which we shall call deep level and surface level processing, correspond to different aspects of the learning material on which the learner focuses. (1976, p. 7)

They reiterated:

> The fundamental importance of recognising the necessary link between the level of processing adopted by the student and the level of understanding reached cannot be overstated. Students adopt an approach determined by their expectations of what is required of them. (p. 125)

In 1979, Saljo reported on the other face of the coin and determined that not only did students approach tasks in different ways according to the context of the tasks, but that students understood *learning* in different ways. Marton (1981) considered that conceptual understanding of learning is based upon the relation between the students' experience of learning and their reflections upon the experience. Marton suggested that learning is a complex interaction between an 'internal horizon' and an 'external horizon'. The internal horizon is the 'how' aspect of learning and consists of three component parts: the actor, the act of learning and the object acted upon (i.e. bits of knowledge). The external horizon comprises the students' 'lived world'. These two aspects define an interplay between the students' experiences of the world in which they live, and their expectation for learning a specific thing. Learning in higher education, however, often neglects the idea that aspects of the 'lived world' impinge on students' learning.

Crawford et al. (1994) interviewed students about their understanding of *what* is learned in mathematics and elicited a wide range of responses. The responses ranged from understanding mathematics as 'the study of numbers and the application of various methods of changing numbers' to understanding mathematics as 'an abstract

reasoning process which can be utilised to explore and solve problems'. Their paper focused on the variation in the way that students understood a specific disciplinary content.

Entwistle and Marton (1994) postulated that when a content is 'learned' there are aspects of that content that come to the foreground when needed, whilst other aspects recede into the background. The ability to discern the movement of encapsulated knowledge from background to foreground was considered an important factor related to high quality learning. 'Only some aspects of these entities [integrated understanding] could be visualised, but additional associated knowledge was readily "available" when needed' (1994, p. 166). In this regard, it is apparent that 'creative' learning happens when students are able to integrate several seemingly different things into a new and unique form.

This has been described by Biggs (1999, p. 47) as the highest level of the 'Structure of the Observed Learning Outcome' (SOLO). In that taxonomy, the highest level is described as the 'extended abstract', where some students are able to relate existing principles to unseen problems. These students are able to question existing ideas and move beyond them (p. 48). Koestler (1964) maintained that a single schema can describe 'creativity' in any field: it occurs when a given field of skills is brought to intersect with a second field (a process that he calls 'bisociation'). This seems to be equivalent to the highest level of the SOLO taxonomy. He asserts that an important aspect of creativity is 'combinatorial' – putting together ideas in unusual combinations – and cites Einstein, saying that his creative thinking consisted of a kind of 'combinatorial play'.

Creativity has also emerged as an element of the 'generic skills' and 'graduate attributes' movement. Employers of university graduates in Australia have indicated that they value the 'skill' of creativity more highly than any other. 'The skills employers consider to be the *most* important in graduates are creativity and flair, enthusiasm and the capacity for independent and critical thinking' (DETYA 2000, p. 14). Recently, Environment Australia has also recognised the importance of creativity for sustainable development and has collaborated with Macquarie University to fund a project to investigate the relationship between sustainability and creativity in postgraduate learning environments (Tilbury *et al* 2003). Given the importance of creativity to graduates' future careers, it is alarming to note that the same group of employers declared this to be the area in which graduates were most deficient.

> Taking into account the relative importance of the skills to employers, the greatest skill deficiencies among new graduates were perceived to be in the area of creativity and flair … Creativity and flair were the most

> important of the skills tested, yet received only a mediocre performance rating. (Tilbury *et al* 2003, p. viii)

The significance of including creativity amongst the most important areas of learning was highlighted by the World Conference on Higher Education (UNESCO 1998), where creativity was proclaimed as an 'innovative educational approach' in Article 9 of their statement on Missions and Functions of Higher Education. Creativity, then, must be regarded as an essential component of any learning situation and a discussion of what creativity means must take place within every discipline and classroom interaction.

Learning is a complex interaction between teachers and learners, teaching and learning, and how the content and purpose of learning is understood. Every learning context produces a set of salient differences in terms of environment, content, process and intent. 'Learning' is no mere acquisition of facts, but a process involving an interplay between the students' individual intentions, experiences and reflections, a body of professional knowledge, institutional expectations and intended outcomes, cultural and societal expectations, and the students' own particular interests.

We can now progress further in answering our first question: How do we as educators set up a total learning environment so that creativity is enhanced in the process of learning and is evident in the products of learning? The relational theory of learning suggests that if students perceive the learning environment to support higher levels of learning then they will probably produce learning outcomes that demonstrate their ability to apply their knowledge in new and startling ways.

Principles of pedagogy that encourage creative learning

A relational theory of learning combined with an understanding of aspects of creativity implies that there must be some pedagogical principles that can be applied to any learning situation. In a study of learning instrumental music (Reid 2001), it became apparent that students understood learning in several different ways, and that their understanding of learning was related to their perception of their intended work. This meant that students who were able to anticipate a musical career that was oriented around communicating personal meaning through music learned music in a way that was related to this aim. For instance, when 'learning' a concerto, students would anticipate the final goal of performance and plan a way in which their performance would be considered *by the listeners* as unique and (dare we say it!) creative. To get to this point, students would use learning strategies that at times sounded the same as students who only anticipated getting through the performance. So, what the students *did* sounded similar but their *intentions* and *outcomes* were completely dissimilar.

From this example we can see that such students had an overall idea of what their personal learning outcomes would be. They understood what they intended to achieve as an outcome of learning, and they were able to determine what practical and intellectual strategies to use. In this regard, these students have moved a long way towards Swede's suggestion that creativity is unique and has value, and towards Koestler's idea of creativity, as they move towards integrating several known musical aspects. Put simply, such students have engaged with learning in a way that supports their learning process and their learning product.

Previously we suggested that Biggs' SOLO taxonomy could help us interpret the quality of the final student learning outcomes (or the product), and that the best outcome for the enhancement of creativity would be the highest level – the 'extended abstract'. In a study of students' understanding of photosynthesis (Hazel et al. 1996), it was discovered that student responses to the following statement could be classified in the SOLO taxonomy only up to the 'relational' level: 'A river has been infected with rapidly growing green alga [sic]. In terms of photosynthetic reactions, describe what happens when light falls on the algae, what happens at night, and any differences between the two situations' (Prosser and Trigwell 1999, pp. 119–20). The 'extended abstract' responses were not evident. In this situation, it appears that the environment was either not supportive of student learning at the highest level, or that students did not perceive the importance of the statement. This example suggests that as educators we need to support the process of learning (creating) as much as examining the final product (creation).

The two examples in this section come from completely different discipline contexts. Yet an important commonality is evident. In order to obtain high level/creative learning, students need a learning environment in which they have an understanding of where they are headed, and they need freedom to explore a way through to the outcome that is unique (or at least integrative).

A teacher of design touched on one of the most important aspects of teaching when she said: 'The brief is terribly important, because if the brief isn't clearly defined and explained and understood by the person [i.e. the student] who's attempting to answer it, then you might as well not start.' Here, the teacher focuses on the student's understanding of the problem and the way in which that student will go about working out what the question is before she comes to resolve it. In this way, a teacher who is oriented towards helping students explore and define problems enhances and expands the students' learning situation. So, the educational principles that support creative learning are that students need to be supported as they determine the problems to be solved and that they need to be given enough latitude to reach a conclusion (or product) that enables them to make interesting and innovative connections.

A collaborative research project focusing on teachers' and students' understanding of design and creativity identified some different perceptions of professional work and learning (Davies and Reid 2001). These perceptions were then integrated with SOLO to provide a context within which creativity in design could be recognised by students and their assessors. For instance, students who understand the nature of professional work as 'extrinsic technical' – that is a focus on the *doing* of design – produce assessment outcomes that 'are skills focused with an understanding of the interrelationships and hierarchies of techniques required in the design profession. The student will be motivated to explain their insights to others including their teachers', which is related to the relational aspect of SOLO. Students who understand design to be a personal engagement – the 'intrinsic meaning' that focuses on *living* – produce outcomes that are 'articulated within a social context and relate to the needs of the audience/consumers. Design is seen as identifying and solving problems within a moral and social context', again from the relational aspect of SOLO (Reid and Davies 2003). In this context the relational aspect of SOLO is interpreted differently if the orientation of the designer, or the design teacher, is taken into account.

The examples in this section highlight the importance of the players within a learning situation. They also highlight a problem in the debate about creativity in learning: that creativity is perceived differently in different disciplines. A creative outcome in one field may not be perceived as creative in another. So another question is raised: What does creativity mean in different domains and what implications are there for learning?

Domains of learning and creativity

Csikszentmihalyi suggests that 'One finds that it is impossible to define creativity independently of judgements based on criteria that change from domain to domain and across time' (1990, p. 198). This view implies that 'creativity' is a social construction. This means that creativity can only be understood as creative by people who share the same sorts of experience and culture. In this sense the concept of the 'value' of the process or product is again important. For instance, the artist Hieronymus Bosch painted in the Middle Ages. At that time his work was considered somewhat quirky but he used processes that were familiar to his audience even if the product was a little odd. Today, his work could be labelled 'surreal'.

Csikszentmihalyi postulates that

> in order to understand creativity one must enlarge the conception of what the process is, moving from an exclusive focus on the individual to a systematic perspective that includes the social and cultural context in which the 'creative' person operates. (1990, p. 190)

and that

> creativity [is] the result of the interactions between three sub-systems: a domain, a person, and a field. Each sub-system performs a specific function. The domain transmits information to the person, the person produces the variation, which may or may not be selected by the field, and the field in turn will pass the selected variation to the domain. (p. 200)

These considerations of the domain in which creativity is understood are exceedingly important for educators. As teachers, we are experienced in understanding what is an 'average student performance' and can distinguish between that and something that is truly exceptional. We have this ability because we know what can be counted as 'ordinary' within a discipline and what is not. An application of this would be in the criteria that we set for assessment. The criteria send an explicit message to the student about the boundaries of the subject and the sorts of things that will allow teachers to validate their learning. The criteria also give teachers a way of judging the quality of learning, and they also allow them to appreciate what is different or unusual in student thinking (provided these criteria are set up well). Looking at assessment, it is clear that a creative submission from a student would satisfy the assessment criteria and in some way go beyond them. The relationship between creativity and learning outcomes and processes seems to be a tacitly agreed phenomenon:

> The field is composed of individuals who know the domain's grammar of rules and are more or less loosely organised to act as gatekeepers to it. The field decides whether an individual's performance meets the criteria of the domain. (Csikszentmihalyi 1990, p. 201)

As teachers we would do well to consider this 'systems view of creativity'. In essence, academics and students are the field of the domain. The domain may include the curriculum (and assumptions and perceptions about the curriculum or content) and the industry standards, but the recognition of creativity is determined by the field. Each of the three aspects is related to each other, 'creative persons … are part of a creative system' (Csikszentmihalyi 1990, p. 206). Logically then, in order to encourage the development and demonstration of creativity in students, we have to focus our attention on providing support for creativity through the culture of the domain and the judgements of the field.

The total learning environment: some examples

The total learning environment can be understood as the pedagogical equivalent to a specific domain. The total learning environment is made of the teachers' and students'

prior understandings and experiences of the discipline field, their perceptions of the curriculum and their learning and teaching outcomes. Petocz and Reid (2002) suggest that

> developing a learning environment that supports high-quality student learning, covers curriculum that is relevant to students and their future work, caters for diverse student and academic populations and fits into university strategic plans has always been a major challenge for academic staff.

The debate on creativity leads us to believe that the challenge for the development of the learning environment needs to be taken up to focus on and enhance the processes and outcomes of creativity at every level. We will give some examples in order to demonstrate a coherent structure for the development of 'creative' learning environments. Each of these examples will show a different learning domain and describe ways in which creative teaching and learning can be encouraged and supported.

Music

Recent research about the ways that musicians and their students understand teaching and learning (Reid 2000a, 2000b, 2001) has shown that there is a strong relationship between how students perceive and experience work as a musician and what they learn, and also between the teacher's experience of work as a musician and what they think is important to teach. It is in the negotiations over what is important for musicians to teach and learn that creativity in this field is recognised by the participants. Traditionally, teachers teach as they themselves were taught, and students' understanding of music and performance is largely ignored. Reid's research discovered several different ways in which teachers understand the overall domain (referred to as the 'music entity'), their intentions about teaching and learning, related strategies for teaching and learning, and intentions about the learning outcome.

In the most limited view teacher and student understood the world of music to be about technical proficiency with an orientation towards examinations. In the most integrated and expansive view music was understood as a way of communicating a personal meaning. These different ways of thinking (and other intermediate views) support quite different learning outcomes. The first focuses on the development of technical accuracy, with the associated learning strategy of drill and practice. From this dimension, creativity is attributed to the talented few, and the learning situation demands that the student work hard on the technical components of music making so that some time in the future it may all come together in a creative burst. The learning situation in this case does not afford the development or discussion of creativity as the student is mainly encouraged

to 'copy' the teacher (Persson 1996). This learning situation rigidly controls student work. The more expansive view focuses on the development of personal meanings through music, and uses a variety of learning strategies to support it, allowing students the freedom to formulate their own problems and to find their own solutions (What music should I study? How do I interpret the music? How can I make it meaningful to me? How will the music help me to communicate my ideas? What concert venue should I use? How do I see the whole work? What things can I do that will make it sound different from all other renditions? etc.). The teachers support this type of creative learning by providing a huge variety of options, by encouraging multi-disciplinary experiences and by the sorts of comments they give in feedback on the practice and the performance. In this latter way of thinking, the learning situation focuses on joint explorations of musical and aesthetic ideas. Teachers and students who focus only on the technical components of music making do not value (or even recognise) the more nebulous creative qualities found when students are able to develop their own musical questions and express a considered personal response through performance.

Academic staff development

In this domain, teachers are the students and their learning revolves around the success of their own students' learning. In an academic development course at Macquarie University, academics in the field of hospitality and tourism were encouraged to define their own areas of need (i.e. to find the problem), to determine the sorts of areas where they could find support for their learning, to define a project that would support their learning, to reflect upon their project through the medium of a personal journal, and finally to assess the quality of their own learning outcomes. Their learning about learning was supported through peer group interactions, a wide range of reading and discussion materials, online conferencing and discussion, and through focusing on student learning from several different perspectives. The outcome of this was that teachers could have their own model of teaching (often didactic teaching) challenged as they themselves became the problem finders, solvers and creators.

The nature of scholarship and creativity in hospitality and tourism was largely undefined, with academics' personal disciplines ranging from 'cheese' to 'beverages', 'English literature' to 'statistics'. The activities involved in the course enabled the participants to research the aspects critical to cheese (for example) and to define what they thought creativity meant in this domain. Using the topic of 'cheese', the teacher and the students explored how the different manufacturing techniques for cheese resulted in different tastes and textures. This fairly technical component of the curriculum was then linked to taste and presentation, where various forms and preparations of cheese could be used to enhance the enjoyment of a multitude of dishes.

Providing a space for teachers (and ultimately students) to challenge assumptions about their own discipline provided a model for these teachers to challenge their own students' views. In this domain there was a strong relation between conceptual and practical components of the discipline that led to interesting explorations of creativity and the way creativity could be recognised, taught and evaluated. As in the music example, it is the negotiation and agreement of what creativity means within a discipline that makes it recognisable, and enables the quality of the creative act to be analysed.

Statistics

A recent study has investigated the ways in which students understand learning in statistics (Petocz and Reid 2001, Reid and Petocz 2002). Analysis of interviews with students shows that there is a hierarchy of conceptions of learning. Students reporting the most limited levels regard learning as doing required activities in order to 'pass' assessment tasks and as collecting information and techniques for later use (usually in examinations). Students using the most expansive level see statistics as an intellectual tool that can inform their understanding of many other areas, and view learning in statistics as a way of using statistical concepts to change their view of the world. Again, the limited levels of learning do not afford scope for creativity, while the most expansive level seems to demand it.

In statistics courses in the Department of Mathematics at the University of Technology, Sydney (UTS), staff and students discuss and negotiate the meaning of a 'creative analysis'. Viewed from the outside, statistics is not generally thought of as a 'creative' field; yet 'numerical detective work' (according to our favourite definition) affords much scope for creativity of process and product. Data sometimes have to be cajoled into giving up their clues, and while there are many standard techniques forming a science of statistics, there is also an important element of art in the process. Students are encouraged to do much of their learning in laboratory classes using statistical packages with powerful graphics, an important tool in data analysis. In regular evaluations, many of them rate these laboratories as the most positive aspect of their studies, reporting that they are able to visualise data and see the connections between variables (see Prvan et al. 2002). An impressive example of a recent advance in the area of graphics is the development of 'trellis graphs', or multi-way dotplots (Cleveland 1993). Trellis graphs allow us to display the effect of one variable (a predictor) on another variable (a response), while allowing for (or conditioning on) the values of one or more other variables. Such graphs are implemented in an interactive form in the S-Plus statistics package (MathSoft Inc 2000), and in recent classes (conducted by Petocz) these trellis graphs have enabled students to become more efficient and creative 'numerical detectives'. One student commented: 'It makes it more interesting for me to see that I am actually creating something using statistics

… that is what attracts me to that field, because I have a very creative side and I like thinking harder and beyond what is given to me.'(Reid and Petocz 2002, section 3) Using a statistical technique that supports the more expansive levels of learning enables students to create a space in which they can express their creativity.

Design

The coordinators of the first-year design course at UTS have recognised for many years that students learn well in multi-disciplinary group situations. The product–process nexus is clearly visible in the domain of design and teachers will often focus on one or other of these when assessing student learning. In this first-year program students are invited to explore the notion of 'identity'.

Students of design have described their understanding of the nature of design in many qualitatively different ways (Davies and Reid 2001). For instance students have described three qualitatively different conceptions of learning design. At the most limiting level, students experience design as the development of skills, the acquisition of knowledge and the ability to remember different techniques. This view may be contrasted with the next level, where learning is about becoming a designer. In this category, students see themselves as part of a design clique in which experimentation with processes is characteristic. At the most integrated and expansive level students describe learning to be about innovation, adaptation and change. This final conception, which is inclusive of the others, focuses on the discovery of a personal identity, on self-expression, on reflection and research, and on the integration and expansion of ideas and practice.

Following Marvszewski (1995), it can be postulated that students who identify with the broadest conceptions can also recognise various qualities of creativity and can actively plan a designed artefact that can be recognised as creative. One student commented: 'If you stretch yourself and you know you try and step well outside your comfort zone and do something you have never done before, that is creative'(Davies and Reid 2001, p.180) At the other end of the spectrum, students who identify only the narrowest conceptions may not be able to plan a creative act, as they are focused only on fulfilling assessment tasks. It seems obvious that higher-level conceptions of design are related to a greater depth of understanding of what creativity means within that domain.

Additionally, students are encouraged through assessment tasks to work as a group. These groups, supported by the availability of a tutor and by regular discussion, are also expected to produce results that display their creativity. However the 'real learning' happens within the small groups as they research and define how they understand 'identity' (the title and focus of the first assessment task). They determine

what the group processes are that will enable them to work and how this group working will be assessed. They decide how they will demonstrate their *understanding* of 'identity' and how the quality of their demonstration will be assessed.

The notion of creativity is fundamental to design and is a focus for nearly all discussion of the subject and its assessment. Creativity is actively assessed and is often misunderstood. The group activities were intended to help students focus on what creativity meant within the context of their assessment task and in the way in which the group would work. This approach is in harmony with the ideas of Swede (1993), who suggests that creativity may be a function of a group, and that working/learning within a group environment will assist students to challenge their individual assumptions.

Conclusion

These examples demonstrate the huge variation in the way creativity is understood in different learning domains. In music, creativity is interpreted as a negotiation between individual teachers and students, their combined experiences of music making and the needs and responses of the listening audience. In hospitality and tourism, creativity is seen through a shared interpretation of their practice and service-oriented discipline. Statisticians see creativity manifested in the representation and interpretation of data, whilst designers can define creativity as an aspect of group processes that lead to a creative production. Each of these examples explores aspects of what creativity means within their specific learning/teaching environment.

The question at the heart of this paper – 'How do we as educators set up a total learning environment so that creativity is enhanced in the process of learning and is evident in the product of learning?' – has been answered to some extent within this paper. The *total* learning environment in any domain should be considered carefully. Educators need to explore what it means to be creative within a particular field and how creativity may be encountered, practiced and produced by students. It is critically important to remember that creativity is not a stable idea but one that is constituted differently within different domains. Therefore, in order to set up a situation in which creativity can occur, educators need to rethink the role that creativity plays in their curriculum and then examine their own understanding of creativity as an element of their own profession, as part of their own approach to teaching, and as part of their academic discipline. It is then necessary to consider the *domain* in which the students and teachers are collaborating, and to set up deliberate classroom situations where the ideas surrounding creativity in that discipline are actively discussed and articulated. Once articulated and agreed, activities and assessments need to provide

opportunities for students to *be* creative, to *demonstrate* creativity, and to *critique* creative processes and outcomes.

It is also critical to remember that learning is a relationship between the ways that students perceive the learning environment and the ways that they then go about learning in it. Importantly, students who identify with the lower, fragmented conceptions of learning can be encouraged to engage with their learning at a higher level through an appropriate learning environment (Reid 2000b). Thus, an effective learning environment, which provides the situation in which creativity can occur, needs to focus on the intersections between students' own ideas of learning – contrasted and compared with their peers' notions about learning – and then supported and challenged by their ideas surrounding creativity. The total learning environment can only be enhanced when ideas of student learning, assessment and creativity are integrated.

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